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SIMILARITIES AND DIFFERENCES CONCERNING THE BALANCE CAPACITY OF SPORT FACULTY STUDENTS

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Abstract

The purpose of the research was to determine what are the similarities and differences of the balance capacity encountered among second year students of Physical Education and Sports department.
Fourteen students (8 boys and 6 girls) were measured during the experimental approach studying Physical Education and Sports (PES) and Sport and Motor Performance (SMP) programs, seven from each program. For the PES program five boys and two girls were measured, while for the SMP program, the group consisted of four girls and three boys. The measurements were focused on the investigation of the bipodal balance (static and dynamic). The results obtained showed a better balance capacity for PES students compared to SMP students, the biggest differences being recorded in static balance measurements (81,86% vs. 69%). The same trend was maintained in terms of horizontal dynamic balance (76,14% vs. 62,14%) with the observation that at the measurements that tested the vertically dynamic balance, SMP students had higher values compared to the colleagues from the PES program (78,43% vs. 76,71%). In conclusion, both groups of students showed similar tendencies in terms of dynamic balance, meaning that all students demonstrated a better vertical dynamic balance capacity and a wicker horizontal one. In terms of static balance capacity the subjects demonstrated oscillatory trajectories, the PES students showing better results than the SMP ones.

Keywords: Motor control, sensorial system, sport activities.

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1. Introduction

Balance is generally defined as the ability to maintain the body's center of mass within its base of support and can be categorized as either static or dynamic balance. Static balance is the ability to sustain the body in static balance or within its base of support. Dynamic balance is supported to be more challenging because it requires the ability to maintain balance during a transition from a dynamic to a static state. Both static and dynamic balance require integration of visual, vestibular, and proprioceptive inputs to produce an efferent response to control the body within its base of support (Olmsted, Carcia, Hertel, & Shultz, 2002; Ross & Guskiewicz, 2004; Karadenizli et al., 2014). To maintain human body balance, anatomical and functional integrity of the vestibular system, located in the inner ear, is essential. The vestibulo-cochlear system has a dual function — the cochlea is responsible for the auditory function, and the vestibular system is responsible for body balance. However, hearing ability is actually a secondary feature, because the primary function of the auditory organ is to maintain body balance (Steindl, Kunz, Schrott-Fischer, & Scholtz, 2006; Northern & Downs, 2002; Melo et al., 2017). Maintenance of balance refers to the ability to respond to any small change by correcting the tension of the whole body. Furthermore, balance is a complex exercise control task that includes the integration of sensory information and the response of the nervous system. Postural reaction is the process that works cooperatively by synergism of muscles between legs and body. In controlling balance, a sensory process is progressed through interaction between inputs that enter from the somatosensory system, visual system and vestibular system including the proprioceptive senses (Lim, Hwnagbo, Nam, & Cho, 2014; de Haart, Geurts, Huidekoper, Fasotti, & Limbeek, 2004; Woollacott, Shumway – Cook, &Nashner, 1983).

Usually, we can say that an individual has a good or bad balance capacity by the way he or she is able to practice different motions without being imbalanced, this thing being assess by the efficient positioning of the feet on the ground. The feet require proper weight distribution during many body motions such as those for the maintenance of static balance and gait. Therefore, the feet have impact-absorbing structures, such as transverse, medial longitudinal and lateral arches, to distribute the body weight during both static and dynamic states (Hyong Hyouk, & Kang, 2016).

Some studies suggest that the advanced levels of balance in highly experienced athletes may result from repetitive exercises that influence motor responses, or these advanced skills of the athletes may be related to proprioceptive and visual movement. Although they have not yet developed a common ground, the experts suggest that the alterations in both sensorial and motor systems influence balance performance (Bressel, Yonker, Kras, & Heath, 2007; Ateş, 2017).

2. Problem Statement

The students of physical education and sports faculties have different features in terms of motor skills and how they can adapt to different motor situations and activities. Motor experience can influence their psycho-motor behaviour during their specific activities of the study programs that are followed, most of the time, those who have practiced for a longer time a certain sport, at a higher level of sports classification, showing more availability in the achievement of the proposed educational and motor goals.

The study programs followed by the students involved in the research are oriented towards two directions: physical and sports education and sport and motor performance. Both include disciplines with a

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theoretical and practical character, their content being focused either to physical education or to performance sport.

3. Research Questions

We started this research from the hypothesis according which if we will measure the static and dynamic balance among the students of couple different study programs but specific to the physical education and sport faculties, then we will be able to identify if there are differences concerning the balance capacity of these students.

4. Purpose of the Study

The purpose of the research was to determine what are the similarities and differences of the balance capacity encountered among second year students of Physical Education and Sports department.

5. Research Methods

This scientific approach was designed based on the following research methods: the documentary informatics method - in order to identify and study the main researches that were achieved in the direction of this theme; the observation method – in order to monitor the behaviour of the subjects involved in this research; the statistical method - to process and centralize the recorded data from measurements; the testing method - to measure subjects' balance capacity, the graphical method - to highlight the trends emerging from the measurements.

5.1. Subjects

Fourteen students (8 boys and 6 girls) were measured during the testing approach, all of them studying Physical Education and Sports (PES) and Sport and Motor Performance (SMP) programs, seven from each program. For the PES program five boys and two girls were measured, while for the SMP program, the group consisted of four girls and three boys. The measurements were focused on the investigation of the bipodal balance (static and dynamic) using the Sensamove balance Miniboard. The SMP students were students who have practiced or are practicing sports in an sportive structure (Handball and Tennis) while the PES students were students who, most of them, have practiced sports like leisure activities.

5.2. Data acquisition

The software of the balance board provided real-time visual feedback so that the subjects had the possibility to see and adjust their neuromuscular response in order to be able to achieve the balance tasks. The results of each subject were recorded via balance board software, received a performance score expressed in percentage (%) according to the balance behaviour and were tabled according to the data acquisition design that was established for each student and balance test type.

In terms of tests tasks, ***the static balance*** required a still position of the subjects on the balance board and it was reflected in keeping a red ball as still as possible on the PC software window. ***The dynamic balance*** test requirements were focused on moving the balance board on front-back and left-right direction

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which was reflected on the software window in the displacing of the red ball inside of a given shape on two directions (vertically and horizontally).

5.3. Data analysis

The data analysis was done via Microsoft Office Excel program using the following statistic parameters: average, standard deviation, the coefficient of variance, the correlation test and the "t" test. These indices were applied in order to see if there were any similarities or differences in terms of static or dynamic balance between the two study programs and to see if the differences were a significant ones.

6. Findings

The results obtained from the measurements allowed us to tighten the data, highlighting the trends recorded for the two types of balance (static and dynamic). In the following tables and graphs we can see the results of each subject, expressed as percentage (table 1, table 3, figures 01 and 02), as well as the values of the statistical indicators related to the two study programs (table 1, 2, 3, 4 and 5).

Table 01. The balance test results of the Physical Education and Sports students (PES)

Subjects	**Dynamic balance (% performance score)**		**Static balance (% performance score)**
	Vertical	***Horizontal***	
	Front -Back	***Left - Right***	
S1	93	78	82
S2	74	80	85
S3	64	61	73
S4	74	73	77
S5	74	80	75
S6	78	87	92
S7	80	74	89
Average	76,71	76,14	81,86
St. deviation	± 8,77	± 8,11	± 7,22
CV (%)	11,43	10,65	8,82

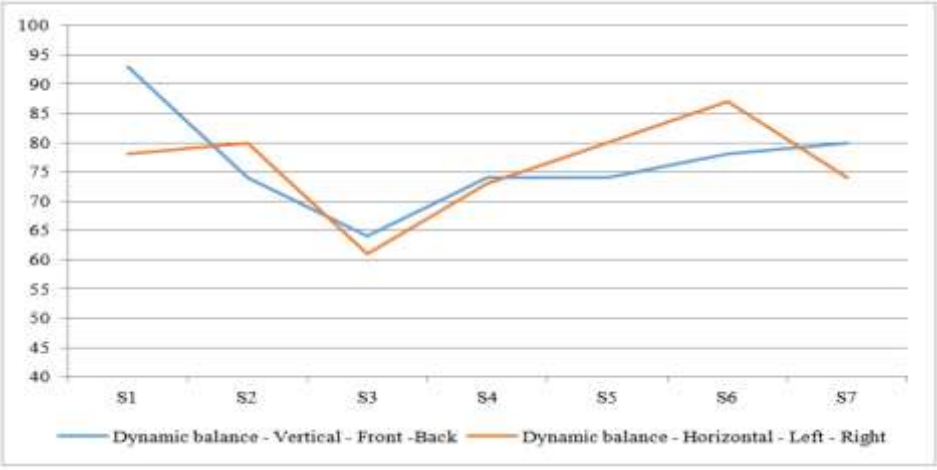

Figure 01. PES students dynamic balance performance score (%)

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The data fron table 01 presents the results of PES study program students to static and dynamic balance measurements. Regarding ***the static balance*** we can see a dynamics of the results between 75 and 92%, with an average of 81.86%, a standard deviation of ± 7.22% and a coefficient of variability of 8.82%. ***The dynamic balance*** results show similar dynamics (figure 01), the percentages being approximate in value, with an average of 76.71% (vertical), respectively 76.14% (horizontal), standard deviation of ± 8.77%, respectively ± 8.11%.

Table 02. The correlation of the balance test results for Physical Education and Sports students

Statistics parameters		
Correlation	D	0,51
	VS	0,46
	HS	0,65

Legend: (D) - Dynamic balance correlation; (VS) - Vertical – static balance correlation; (HS) - Horizontal – static balance correlation.

In table 02 are presented the results of the linear correlation coefficient between: the two types of dynamic balance (D = 0,51); dynamic vertical balance and static balance (VS = 0.46); dynamic horizontal balance and static balance (HS = 0.65). The data indicates a positive medium correlation between the measured balance types, the best correlation being between the dynamic horizontal balance and static balance.

Table 03. The balance test results of the Sports and Motor Performance students (SMP)

Sports and motor performance			
Subjects	**Dynamic balance (% performance score)**		**Static balance (% performance score)**
	Vertical	***Horizontal***	
	Front -Back	***Left - Right***	
S1	74	59	81
S2	76	63	71
S3	97	86	79
S4	68	44	49
S5	97	72	79
S6	58	64	50
S7	79	47	74
Average	78,43	62,14	69,00
St. deviation	± 14,39	± 14,37	± 13,75
CV (%)	18,34	23,12	19,92

Table 03 shows the results obtained by SMP students at PES students' similar measurements, with different dynamics. Thus, in the case of ***static balance***, the recorded values were between 49 and 81%, with an average of 69%, a standard deviation of ± 13,75% and a coefficient of variability of 19,92%. The two types of dynamic (vertical and horizontal) balance are quite variable (figure 02), with an average of 78.43% (vertical) and 62.14% (horizontal) and a coefficient of variability of 18, 34% (vertical) and 23.12% (horizontal).

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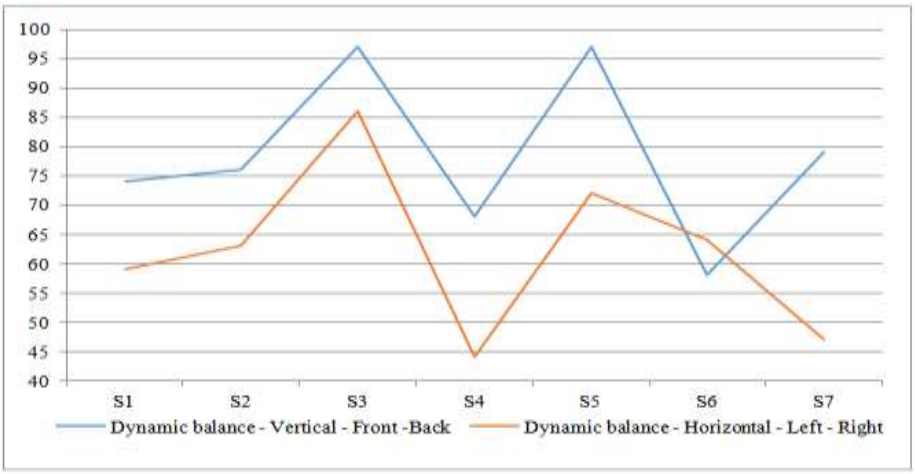

Figure 02. SMP students dynamic balance performance score (%)

Table 04 shows the results of the linear correlation coefficient calculated for the balance types similar to those of PES students. The data signify a positive medium correlation regarding the dynamic horizontal vs. static balance and dynamic balance (HS = 0.47, D = 63). The value of the correlation coefficient between the vertical dynamic balance and the static balance signifies a high correlation (VS = 0.77).

Table 04. The correlation of the balance test results for Sports and Motor Performance students

Statistics parameters		
Correlation	D	0,63
	VS	0,77
	HS	0,47

Legend: (D) - Dynamic balance correlation; (VS) - Vertical – static balance correlation; (HS) - Horizontal – static balance correlation.

Analysing the differences between the two types of equilibrium (table 05, figures 03 and 04) highlighted by the students of the two study programs, we can say that they are statistically significant ($p < 0.05$) in the case of ***horizontal dynamic balance*** (HDB PES - SMP = 2,2447) and static balance (SB PES - SMP = 2,1906). The differences recorded as a result of the vertical dynamic balance measurement show data that are not statistically significant (VDB PES - SMP = 0,2694).

Regarding the analysis of the general balance capacity (static + dynamic), the recorded data show that the differences between the students of the two study programs are statistically insignificant (table 05: PES vs. SMP = 1.2956).

Table 05. The "*t*" test results of the balance test: Physical Education and Sports (PES) vs. Sports and motor performance (SMP) students

T *p<0,05*	VDB PES - SMP	0.2694
	HDB PES - SMP	2.2447
	SB PES - SMP	2.1906
	PES vs. SMP	1.2956

Legend: (VDB PES - SMP) - Vertical Dynamic Balance; (HDB PES - SMP) - Horizontal Dynamic Balance; (SB PES - SMP) - Static Balance; (PES vs. SMP) - Students Balance differences

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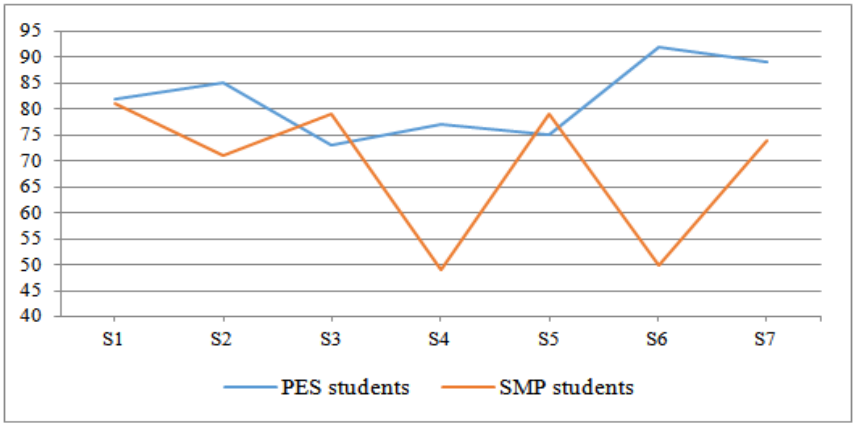

Figure 03. PES vs. SMP static balance differences (%)

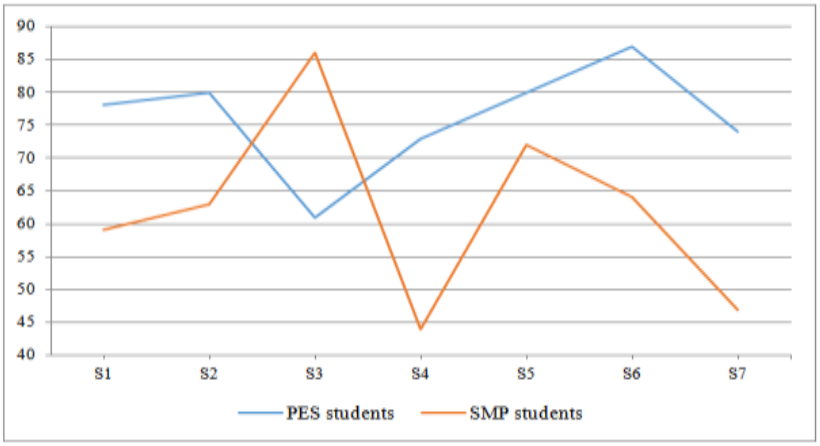

Figure 04. PES vs. SMP dynamic - horizontal balance differences (%)

As a general view, the results obtained showed a better balance capacity for PES students compared to SPM students, the biggest and significant differences being recorded in static balance measurements (81.86% vs. 69%). The same trend was maintained in terms of horizontal dynamic balance (76.14% vs. 62%), with the observation that at the measurements that tested the vertically dynamic balance, SPM students had higher values compared to the colleagues from the PES program (80.17% vs. 76.71%).

7. Conclusion

In conclusion, both groups of students showed similar tendencies in terms of dynamic balance, meaning that all students demonstrated a better vertical dynamic balance capacity and a wicker horizontal one. In terms of static balance capacity the subjects demonstrated oscillatory trajectories, the PES students showing better results than the SMP ones.

The higher values of vertical dynamic balance similarities may occur from the fact that the students are not very focused on the activities that require lateral dynamic balance tasks, most of the actions that the students (PES and SPM) practice being related to forward and backward directions. This fact may underline, one more time that, it is very important to practice exercises that require a variety of the sensorial system tasks in order to improve balance capacity in a proper way.

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